



**MMAE SEMINAR**

**Thomas R. Kurfess, Ph.D., P.E.**  
**Department of Mechanical Engineering**  
**International Center for Automotive Research**  
**Clemson University**

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**Abstract**

**Large Scale Computational Metrology for Large and Micro-Parts**

Modern production facilities have enabled the fabrication of components possessing highly complex geometries. In many instances these geometries cannot be inspected via traditional techniques, and must be inspected using a coordinate metrology approach employing systems such as coordinate measurement machines (CMM's) or optical laser scanning systems. These systems digitize a part's surface into a set of {X, Y, Z} coordinates known as a point cloud. Point clouds can consist of hundreds, thousands and even millions of coordinate points. There are a variety of systems capable of digitizing a part into a point cloud; however, the making practical and pragmatic use of the point cloud is a nontrivial task.

Nominally, there are two major analysis tasks performed on the point cloud. The first is metrology, the second is reverse engineering. For the metrology task, the point cloud must be compared to a CAD model representing the target component geometry. Thus, each point in the cloud must be assigned to the appropriate geometric entity on the CAD file and compared to its nominal value. In the case where a point cloud consists of a million points and the CAD file consists of a thousand surfaces, a billion point to surface calculations must be accomplished for a single iteration during the comparison. This makes the metrology task quite complex and time consuming. Approximations used during this comparison can improve the computational speed of the metrology task, but at the cost of reduced accuracy of the inspection.

This talk addresses a new set of algorithms that provide both increased speed as well as improved accuracy over currently available metrology tools for point cloud to CAD model comparison. These algorithms can be applied to a wide range of geometries from large-scale aircraft to micro and nano devices. Applications to a variety of production components will be presented including inspection of MEMS devices. Digitizing of MEMS devices is also a significant task, and one that requires a new generation of inspection hardware. This during the course of this talk a new micro interferometer system will be presented that enables high speed, and high precision micro-inspection.